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case report

BONE REGENERATION IN AESTHETIC AREAS USING TITANIUM MICROMESH. THREE CASE REPORTS

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SUMMARY

Purpose. An adequate bone volume for complete circumferential coverage of the implants is very important for obtaining a long-term success of oral implants. To avoid these problems various membranes and biomaterials were used, but soft tissue pressure could cause a membrane collapse toward the defect. The present work describes a ridge augmentation with titanium mesh shaped by adapting it to a bone defect in aesthetic areas.

Materials and methods. Three patients with alveolar crest defects received three implants (Bone System, Milano, Italy) and the defects were filled with bone chips. The defects were covered with a titanium micromesh above which was positioned a resorbable membrane (Biogide, Geistlich, Wohlhusen, Switzerland).

Results. At the re-entry procedure the titanium micromesh appeared to be surrounded by a dense connective tissue with no clinical signs of inflammation. Clinically in all patients, no residual bone defects were observed, and a significant increase of the alveolar width or height was found.

Conclusions. In conclusion the clinical results of the present study show that most certainly the space for the bone regeneration is one of the most critical factors in the success of the regenerative techniques.

Key words: bone, regeneration, graft, mesh, titanium.

Introduction

A sufficient volume and quality of alveolar bone must be present at potential implant recipient sites, so as to ensure a predictable long-term outcome in terms of aesthetics and function.

In the last few years, Guided Bone Regeneration (GBR) has been used in recent years for the regeneration of bone in conjunction with the placement of oral implants, for the augmentation of resorbed alveolar crests and best documented method applied to augment bone in localized alveolar defects (1-9). An adequate bone volume for complete circumferential coverage of the implants is very important for obtaining a long-term success of oral implants (10-28).

To avoid these problems, different regenerative surgical techniques have been developed: conventional onlay/inlay grafts (29), interpositional sandwich osteotomies, guided bone regeneration with semipermeable membranes, and alveolar distraction osteogenesis procedures (1, 2, 30). Various materials have been applied to secure the graft material at the recipient site. Non resorbable membranes (31), fixation screws (32), dental implants (33), or titanium mesh 15-16 are the most common securing devices. One of the most important aspects for obtaining results with membranes for lateral ridge augmentation is the

creation and maintenance of a secluded space under the membrane (34): the development of this space is the prime determinant of the amount of newly formed bone (2). The sites for localized ridge augmentation are non space-making defects because they are not supported by the bone walls (34) and, in these situations, an excessive soft tissue pressure could cause a membrane collapse toward the defect (2). Possible solutions to avoid the membrane collapse and to increase the regenerative capabilities of the bone in non space-making situations have been the use of reinforced e-PTFE membranes (2, 10) or the use of miniscrews and pins to support and stabilization the membrane (34). The use of self-reinforced polyglycolide membranes has been advocated (35). Even with miniscrews, however, it is possible to have a lateral collapse of the membrane (34) and so the use of different types of grafts have been proposed to maintain the space between implant and surrounding defect (36).

Semi-rigid membranes are especially useful to treat the vertical component of the ridge deformity (7).

The use of membranes made of titanium micromesh has been advocated (37-40). Aim of the present study was a clinical evaluation of the results obtained in GBR with titanium micromesh and a resorbable membrane in aesthetic areas. The present work describes a ridge augmentation with titanium mesh shaped by adapting it to a bone defect in aesthetic areas.

Materials and methods

Three patients (2 females and 1 male) with a mean age of 56.5 years (range 39-63) participated in this study. These patients required to undergo replacement of missing anterior maxillary teeth with implants from January 2010 to October 2015 at the University of Chieti-Pescara, Faculty of Dentistry Department of Oral Implantology. All patients gave their informed consent. In all patients alveolar crest defects were present (Figure 1). Three implants (Bone System, Milano, Italy) were inserted, usually 4-5 mm above the lower borders of the defects (Figure 1), and the defects were filled with bone, chips obtained from implant site. The defects were then covered with a titanium micromesh (Bone System, Milano, Italy) (Figure 2) above which was positioned a resorbable membrane (Biogide, Geistlich, Wohlhusen, Switzerland). The micromesh was fixed with 3 mm titanium microscrews (Bone System, Milano, Italy). After a healing

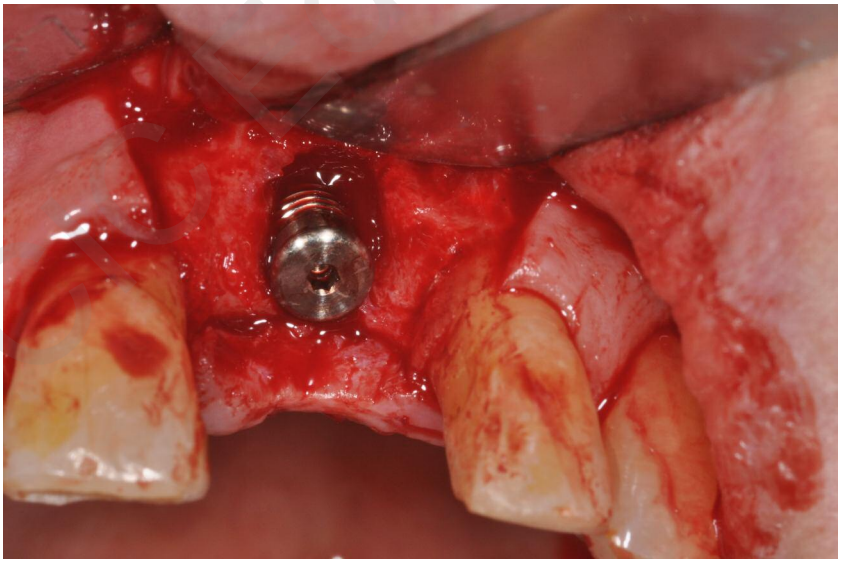

Figure 1
After elevation of the flap it is possible to observe a destruction of the vestibular cortices. A 4.1 mm diameter and 13.5 mm length has been inserted about 5 mm above the lowest border of the defect.

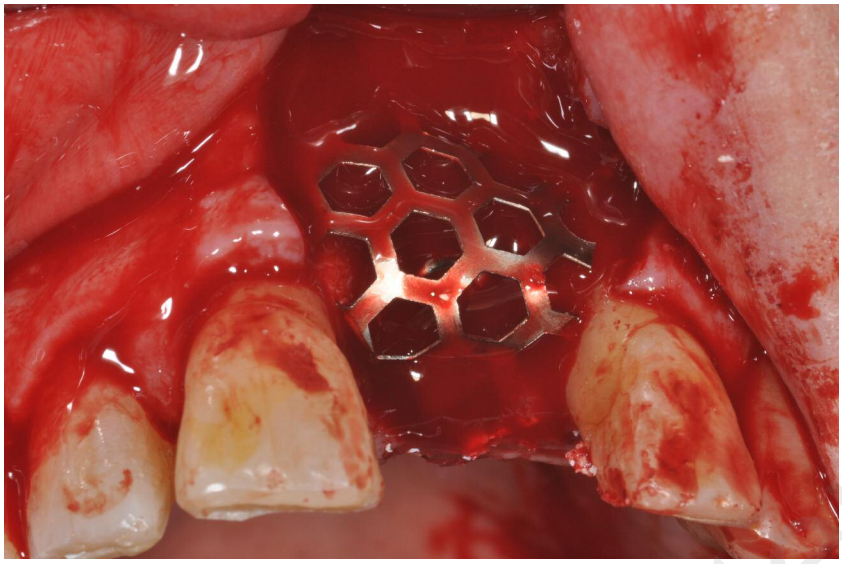

Figure 2
The defect has been filled with bone chips retrieved from the implant site: a titanium mesh is used to cover the autologous bone. The mesh is fixed with microscrews.

period of 6 months the mesh was removed. All patients received pre- and postoperative panoramic radiographs. In addition, periapical radiographs were made before the bone grafting procedure and before implant placement. After 4 months the implants were loaded with provisional acrylic prostheses, replaced, after 4 months, by definitive screw-retained metal-ceramic prostheses.

Results

The postoperative healing was uneventful in all patients. Exposure of the titanium mesh during healing was observed in 1 of the 3 patients. In this patient, soft tissue proliferation and epithelization was noticed to occur underneath the exposed mesh. At the re-entry procedure the titanium micromesh appeared to be surrounded by a dense connective tissue with no clinical signs of inflammation (Figure 3). The micromesh appeared to adhere to the newly formed tissues and, after its removal, a whitish soft tissue was present underneath: this tissue was carefully removed with a curette and it was possible to observe that the space under the titanium mesh and the resorbable membrane was completely filled

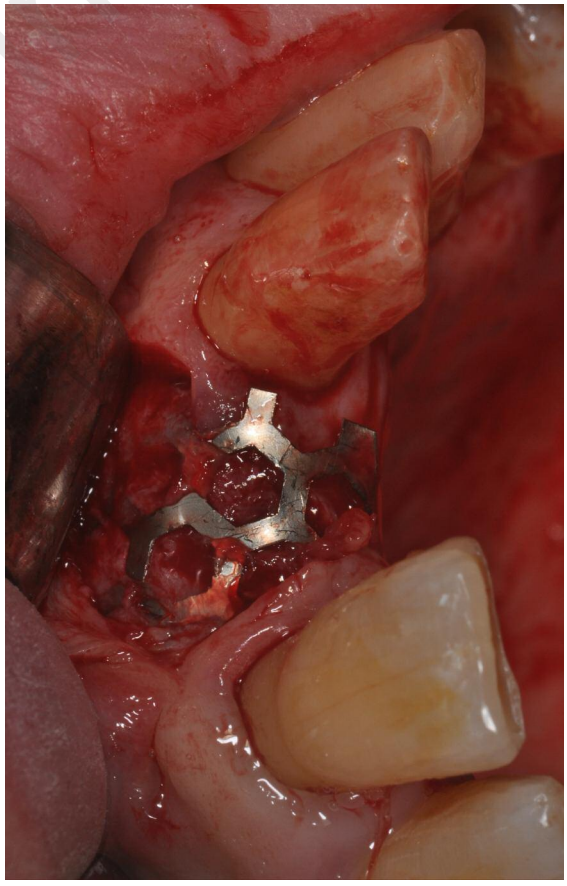

Figure 3
Re-entry procedure after 4 months.

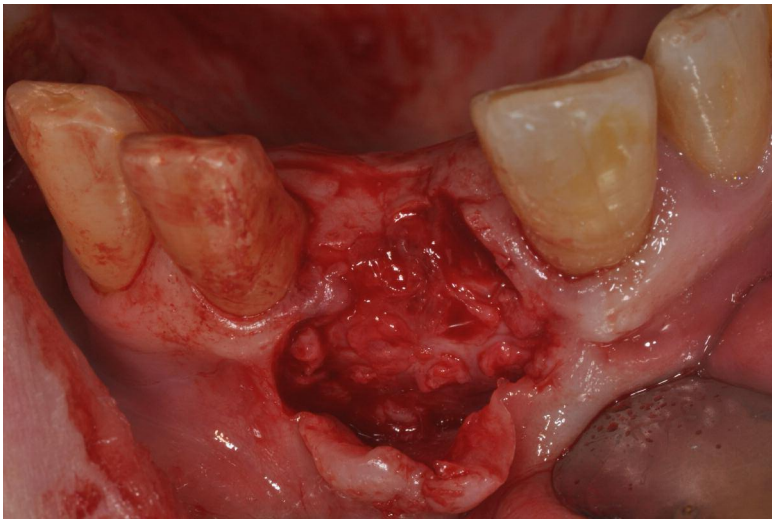

Figure 4
Underneath the mesh it is possible to observe the presence of a tissue with the macroscopic features of mature bone: this tissue cannot be entered with a dental probe.

by a tissue with the macroscopic features of newly formed bone (Figure 4). It was not possible to enter this tissue with a dental probe. From a clinical point of view, in all patients, no residual bone defects were observed, and a significant increase of the alveolar width or height was found (Figures 4, 5). All cases it was possible to observe a good aesthetic result of the restorative procedure. In all treated cases we found newly bone formation after micro mesh removal. In one case micro mesh partial exposure occurred but it had not negative impact on bone regeneration processes.

Discussion

Regeneration of bone in conjunction with placement of oral implants, augmentation of resorbed alveolar ridges, and treatment of localized ridge defects, are quite common clinical situations that can be managed by means of a valuable technique first described in 1959 by Hurley et al., commonly known as guided bone regeneration (GBR), which was developed during experimental reconstructive surgery by Hurley to treat ex-

Figure 5
A screw healing is positioned.

perimental spinal fusion (41) and then applied in oral surgery by Simion and Dahlin (42). A recent clinical study assessed the survival rates of implants either placed with simultaneous with GBR or placed into native bone after a mean observation period of 12.5 years (43). It was found that the implant survival rates for the GBR and the control groups reached 93 and 95%, respectively. Guided bone regeneration is currently used for the treatment of localized ridge augmentation, based on the concept of the membrane as a physical barrier designed to minimize resorption of the grafted bone. There are two types of membrane: resorbable and nonresorbable. One of the main problems in using occlusive membranes is their lack of stiffness that can produce a collapse of the barrier towards the bone defect, reducing in such a way the space needed for the bone regeneration (38-40, 44). This problem can be, in part, overcome with the use of grafts beneath the membrane, but the influence of the overlying soft tissues in collapsing the membrane could still be present. Titanium- micromesh retain their three-dimensional shape with a specific height and width but with this technique there is also a risk of post-operative mucosal dehiscence as they impede the establishment of a proper vascular supply. In all our patients the titanium micromesh was easy to handle, was very ductile, and appeared to have excellent space-making capabilities; no infections were observed in the healing of the soft tissues.

In all our patients the use of grafts under the mesh and the membrane appeared to have a beneficial effect on the amount of bone regeneration in non space-making defects (2). The clinical advantages related to this technique include the possibility of correcting vertical and horizontal atrophies and the lack of major complications if soft-tissue dehiscence and mesh exposures do occur (45-58).

In conclusion the clinical results of the present study show that most certainly the space for the bone regeneration is one of the most critical factors in the success of the regenerative techniques, that the primary closure of the mucoperiosteal flap has a relevant role in the protection of the blood clot and in the prevention of infection (7, 59). The use of a bioresorbable membrane and of grafting material under the barrier membranes is certainly helpful and beneficial.

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